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Short dental implants

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ABSTRACT

Short dental implants have been successfully used to support single and multiple fixed reconstructions in atrophic jaws, despite an increased crown-to-implant ratio. The use of short dental implants allows the treatment of patients for whom complex surgical techniques cannot be performed for medical, anatomical, or financial reasons. Furthermore, the use of short dental implants in clinical practice reduces morbidity, cost, and treatment time and reduces the need for complex surgery. The aim of this review is to evaluate the survival rates of short and extra-short dental implants and to discuss the impact of an increased crown-to-implant ratio on biologic and technical complications.

Keywords: Dental implants, implant-supported dental prosthesis, survival rate

INTRODUCTION

In dental implant treatment, excessively resorbed alveolar bone causes a serious problem during both the surgical and prosthetic phases.[1,2] Over the years, many surgical techniques have been developed to increase bone volume and enable implant placement. These techniques are essential for positioning long dental implants, achieving balanced load distribution, and improving the crown/implant ratio. Techniques such as maxillary sinus elevation, guided bone regeneration, distraction osteogenesis, and inferior alveolar nerve lateralization have been developed to place long dental implants in excessively resorbed alveolar bone. However, these complex surgical techniques are associated with complications such as intraoperative bleeding, perforation of the Schneiderian membrane or nerve damage, temporarily or permanently altered postoperative mandibular sensation, exposure of the graft or membranes, infections, and increased bone loss around the implant.[3] In addition to these complications, increased treatment time and cost, and the fact that advanced surgical techniques are not suitable for some patients for medical or anatomical reasons, alternative treatments are needed. In this context, the use of short dental implants should be considered as an alternative to complex surgeries. Short dental implants allow cheaper and faster treatment with a reduced morbidity rate as well as ease of application.[4] However, survival rates and indications are still controversial. Unfavorable crown/implant ratio, inadequate primary implant stability, and bone-implant contact have been described as reasons for the failure of short dental implants. The aim of this review is to evaluate the survival rates of short and extra-short dental implants and to discuss the impact of an increased crown-to-implant ratio on biologic and technical complications.

DISCUSSION

The length threshold defining a short dental implant is still a matter of debate in the scientific literature.[5] Some researchers consider this value to be <10 mm, while others define extra-short dental implants as <8 mm or even ≤6 mm.[6,7] Taschieri et al. (2018) compared the clinical and radiographic outcomes of 27 patients with short dental implants (6.5-8.5 mm) placed without any additional bone augmentation procedure in the posterior maxilla and 25 patients with standard implants (≥ 10 mm) placed in combination with lateral maxillary sinus floor elevation.[8] After a 72-month follow-up period, no significant differences were observed between the groups in terms of implant failure or changes in marginal bone level. In particular, the short dental implant group was reported to have less postoperative pain, inflammation, and other adverse postoperative effects, as well as faster healing compared to the other group.

In a retrospective study evaluating the performance of short dental implants (≤8 mm) based on different factors, including crown/implant ratio and prosthetic design (e.g., splinted vs. nonsplinted restorations), a total of 180 short dental implants placed in 130 patients were evaluated after 3-7 (mean=4.2) years of follow-up. It was reported that four implants in four different patients failed due to severe peri-implantitis, resulting in an overall cumulative survival rate of 97.8% at the implant level. Furthermore, the mean marginal bone loss was 0.90±0.78 mm. Most sites (70%) were shown to have a crown/implant ratio≥1 (mean=1.16±0.36). Correlation analyses revealed that sites with a crown/implant ratio <1 exhibited greater marginal bone loss (1.14±0.75 mm) compared to sites with ratios of 1-1.99 and ≥2 (0.81±0.77 mm and 0.45±0.47 mm, respectively). It was also observed that peri-implant bone loss and complication rates were not statistically different between splinted and non-splinted prostheses.[9]

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Another retrospective study evaluated the performance of short dental implants (<8 mm) in posterior maxillary and mandibular partially edentulous regions. Data were obtained from the medical records of 148 patients treated with a total of 225 short dental implants between 2005 and 2014, following an observation period of up to 14 years in clinical function, and outcomes such as implant stability, marginal bone loss, and success/survival rates were evaluated. The results of this comprehensive retrospective study revealed an overall success and retention rate of 93.33% and 97.78%, respectively. Cumulative 5- and 10-year survival rates were 99.05% and 96.72%, respectively; mean marginal bone loss was 0.43 mm.[10]

A 2014 Cochrane systematic review and meta-analysis presented four clinical trials evaluating short dental implants (5 to 8.5 mm in length) as an alternative to maxillary sinus floor elevation in areas with residual bone height between 4-mm and 9-mm.[11] One year after loading, there was insufficient evidence to indicate differences between the two procedures in terms of prosthesis (OR=0.37) or implant failure (OR=0.44). However, a higher risk of complications (e.g., infection, bleeding, nerve injury, etc.) has been reported at sites where maxillary sinus floor elevation surgery was performed (OR=4.77).

As part of the 2015 European Association for Osseointegration (EAO) consensus conference, a systematic review was conducted on the performance of short dental implants (≤8 mm) compared to conventional implant placement with maxillary sinus floor elevation.[12] The results of a total of 8 randomized controlled trials published between 1990 and 2014 showed that short dental implants achieved survival rates comparable to standard-length implants placed in combination with maxillary sinus floor elevation (98.0%-99.2% for short dental implants and 99.5%-99.0% for standard-length implants). However, the incidence of complications (Schneiderian membrane perforation) was reported to be three times higher with maxillary sinus floor elevation, resulting in increased morbidity, prolonged healing times, and increased financial expenditure.

In a systematic review of 10 randomized controlled clinical trials comparing long (>6 mm) and short (≤6 mm) dental implants placed in posterior edentulous sites, data from 637 short dental implants and 653 standard-length implants placed in 775 patients were evaluated. In terms of retention rate, short dental implants were found to be associated with higher variability and lower predictability compared to long dental implants after function periods of 1-5 years. However, the mean reported retention rate was 96% (range: 86.7%-100%) for short dental implants and 98% (range: 95%-100%) for longer dental implants.[13]

Regarding extra-short dental implants (≤6 mm), a systematic review and meta-analysis of a total of 24 clinical trials, including 657 dental implants with a maximum follow-up of 5 years, reported that single crowns supported with extra-short dental implants exhibited a similar risk of failure to those supported with conventional dental implants, regardless of the history of maxillary sinus floor elevation, with a cumulative failure rate of [5.19] %. It was also noted that biologic complications were more frequent than biomechanical/prosthetic complications.[14]

Only a few descriptive studies have evaluated the effect of the crown/implant ratio on peri-implant bone loss15-19, implant survival rate.[16,18,20] or the occurrence of biological and technical complications.[18] Among this group of publications, three studies.[15,18,20] included only single-tooth implant-supported restorations, thus avoiding the bias of better occlusal force distribution in studies[16,17,19] that included mainly splinted implant restorations. Three studies showed that marginal bone loss was not related to the crown/implant ratio,[15,18,19] while two studies showed that implant restorations with higher crown/implant ratios exhibited statistically lower marginal bone loss compared to implant restorations with lower crown/implant ratios.[16,17] According to Blanes et al.[16], this may be explained by the stimulating nature of bone stress.

Similar survival rates have been reported for implant restorations with high and low crown/implant ratios.[16,18,20] Furthermore, the crown/implant ratio was found to have no statistically significant effect on the occurrence of biologic and technical complications.[18] These results are in agreement with the results of another systematic review that evaluated the effect of the crown-to-implant ratio on the survival and complication risk of implant-supported reconstructions.[21] It should be noted that most implant-supported restorations have crown-to-implant ratios between 1.0 and 2.0, with little data available for crown-to-implant ratios>2.0. Therefore, the effect of crown-to-implant ratios>2.0 on marginal bone loss should be investigated in more studies.

CONCLUSION

Short dental implants can be successfully used to support single and multiple reconstruction of the atrophic jaw, even with increasing crown-to-implant ratios. The use of short dental implants allows the treatment of patients for whom complex surgical techniques are not feasible for medical, anatomical, and financial reasons. For such patients, the decision may be whether to undergo a short dental implant-supported fixed reconstruction, a removable prosthesis, or a long-fixed reconstruction. Moreover, the use of short dental implants in clinical practice reduces the need for complex surgery and, therefore, morbidity, cost, and treatment time. However, longer observation periods of up to 10 years (for both case series and randomized controlled trials) are needed. Additional studies should also investigate the crown/implant effect of a>2.0 ratio and the possibility of using extra-short dental implants.

ETHICAL DECLARATIONS

Referee Evaluation Process: Externally peer-reviewed.

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REFERENCES

1. Chaushu G, Taicher S, Halamish-Shani T, Givol N. Medicolegal aspects of altered sensation following implant placement in the mandible. *Int J Oral Maxillofac Implants.* 2002;17(3):413-415.
2. Friberg B. The posterior maxilla: clinical considerations and current concepts using Branemark System implants. Periodontol 2000. 2008;47(1):67-78.

3. Esposito M, Grusovin MG, Felice P, Karatzopoulos G, Worthington HV, Coulthard P. The efficacy of horizontal and vertical bone augmentation procedures for dental implants – a Cochrane systematic review. *Eur J Oral Implantol.* 2009;2(3):167-184.
4. Esposito M, Pellegrino G, Pistilli R, Felice P. Rehabilitation of posterior atrophic edentulous jaws: prostheses supported by 5 mm short implants or by longer implants in augmented bone? One-year results from a pilot randomised clinical trial. *Eur J Oral Implantol.* 2011;4(1):21-30.
5. Nisand D, Renouard F. Short implant in limited bone volume. *Periodontol 2000.* 2014;66(1):72- 96.
6. Ravida A, Barootchi S, Askar H, Suarez-Lopez Del Amo F, Tavelli L, Wang HL. Long-term effectiveness of extra-short (≤6 mm) dental implants: a systematic review. *Int J Oral Maxillofac Implants.* 2019; 34(1):68-84.
7. Al-Sawaf O, Tuna T, Rittich A, Kern T, Wolfart S. Randomized clinical trial evaluating the effect of splinting crowns on short implants in the mandible 3 years after loading. *Clin Oral Implants Res.* 2020;31(11):1061-1071.
8. Taschieri S, Lolato A, Testori T, Francetti L, Del Fabbro M. Short dental implants as compared to maxillary sinus augmentation procedure for the rehabilitation of edentulous posterior maxilla: three-year results of a randomized clinical study. *Clin Implant Dent Relat Res.* 2018;20(1):9-20.
9. Tang Y, Yu H, Wang J, Gao M, Qiu L. Influence of crown-to-implant ratio and different prosthetic designs on the clinical conditions of short implants in posterior regions: a 4-year retrospective clinical and radiographic study. *Clin Implant Dent Relat Res.* 2020;22(1):119-127.
10. Ku JK, Kim IH, Lee JG, Kim YK. Long-term clinical evaluation of short implants on posterior partially edentulous areas: a 14-year retrospective study. *Int J Oral Maxillofac Implants.* 2021;36(1):131-136.
11. Esposito M, Felice P, Worthington HV. Interventions for replacing missing teeth: augmentation procedures of the maxillary sinus. *Cochrane Database Syst Rev.* 2014;13(5):CD008397.
12. Thoma DS, Zeltner M, Husler J, Hammerle CH, Jung RE. EAO Supplement Working Group 4 – EAO CC 2015 short implants versus sinus lifting with longer implants to restore the posterior maxilla: a systematic review. *Clin Oral Implants Res.* 2015;26(Suppl 11):154-169.
13. Papaspyridakos P, De Souza A, Vazouras K, Gholami H, Pagni S, Weber HP. Survival rates of short dental implants (≤6 mm) compared with implants longer than 6 mm in posterior jaw areas: a meta-analysis. *Clin Oral Implants Res.* 2018;29(Suppl 16):8-20.
14. Badaro MM, Mendoza Marin DO, Pauletto P, Simek Vega Goncalves TM, Porporatti AL, De Luca Canto G. Failures in single extra-short implants (≤6 mm): a systematic review and metaanalysis. *Int J Oral Maxillofac Implants.* 2021;36(4):669-689.
15. Birdi H, Schulte J, Kovacs A, Weed M, Chuang SK. Crown to-implant ratios of short-length implants. *J Oral Implantol.* 2010;36:425-433.
16. Blanes RJ, Bernard JP, Blanes ZM, Belser UC. A 10-year prospective study of ITI dental implants placed in the posterior region II: Influence of the crown to implant ratio and different prosthetic treatment modalities on crestal bone loss. *Clin Oral Implants Res.* 2007;18(6):707-714
17. Rokni S, Todescan R, Watson P, Pharoah M, Adegbembo AO, Deporter D. An assessment of crown-to-root ratios with short sintered porous-surfaced implants supporting prostheses in partially edentulous patients. *Int J Oral Maxillofac Implants.* 2005;20(1):69-76.
18. Schneider D, Witt L, Hammerle CH. Influence of the crown-to-implant length ratio on the clinical performance of implants supporting single crown restorations: a cross-sectional retrospective 5-year investigation. *Clin Oral Implants Res.* 2012;23(2):169-174.
19. Tawil G, Aboujaoude N, Younan R. Influence of prosthetic parameters on the survival and complication rates of short implants. *Int J Oral Maxillofac Implants.* 2006;21(2):275-282.
20. Schulte J, Flores AM, Weed M. Crown-to-implant ratios of single tooth implant-supported restorations. *J Prosthet Dent.* 2007;98(1):1-5.
21. Blanes RJ. To what extent does the crown-implant ratio affect the survival and complications of implant-supported reconstructions? A systematic review. *Clin Oral Implants Res.* 2009;20(Suppl 4):67-72.